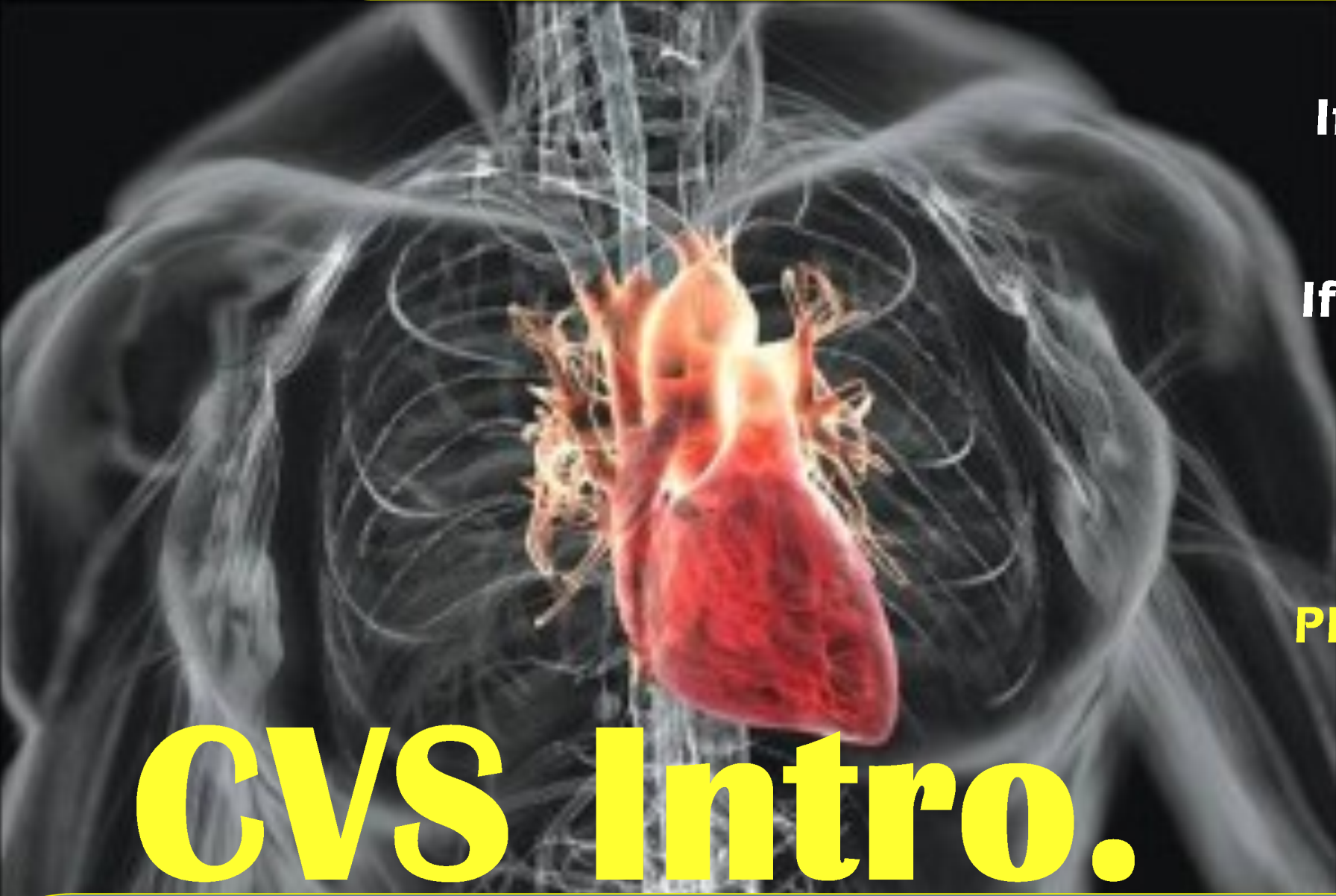


Draw **Pharmacology** *in your mind*



If you are a pharmacy student
If you are postgraduate and want
to revise pharmacology by an
easy way
If you are using any pharmacology
reference

this file will aid you

> And wait for more <

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لا تنسوني من صالح دعائكم

CVS Intro.

Pharmacist. **Alaa Nasr**

د. آلاء نصر

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CARDIOVASCULAR SYSTEM

Introduction

Cardiovascular system

Heart (myocardium)

- The heart is the **muscular pump** of the body (muscle in nature)
- It beats non-stop for the entire life time to **supply blood which is loaded by oxygen and nutrients** to all tissues of the body

Blood vessels

Arteries (bigger) → arterioles (smaller)

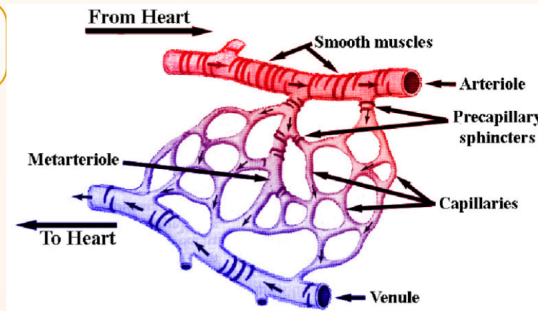
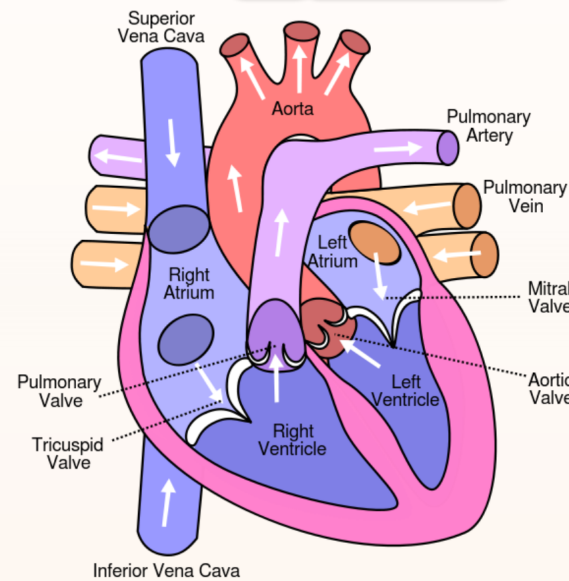
Carrying blood from **heart to tissues**

Veins (bigger) → Venules (smaller)

Carrying blood from **tissues to heart**

Capillaries

Connecting arterioles to venules



Anatomical background about the heart

- It is composed of **4 chambers** → (2 atria and 2 ventricles)
- Venous blood** → enters the **right atrium** through **vena cava** (inferior & superior)
- The blood passes from the **right atrium to the right ventricle** which contracts to push the blood through the **pulmonary artery** to the **lungs** where → **exchange of O₂ and CO₂ occurs**
- Blood **returns to the heart** from the **lungs** through **4 pulmonary veins** that enter the **left atrium**
- Blood passes from the **left atrium to the left ventricle** which contracts to push the blood through **aorta** which then → **distribute blood to all body tissues**

Notes:

- The wall of the **left ventricle** is thicker than the **right ventricle**
- The wall of atria is thinner than ventricles (so left ventricle > right ventricle > atria in thickness)
- Around the heart there are **coronary arteries** which → **supply the heart with blood**

Beating of the heart

- The heart can beat spontaneously at a rate **40 beats/min**
- so, beating of the heart is **myogenic in nature** (not neurogenic) that means → it does not need an intact nerve supply to beat

Evidence

- The heart of the fetus during pregnancy beats before the heart is innervated
- Isolated frog's heart can beat spontaneously

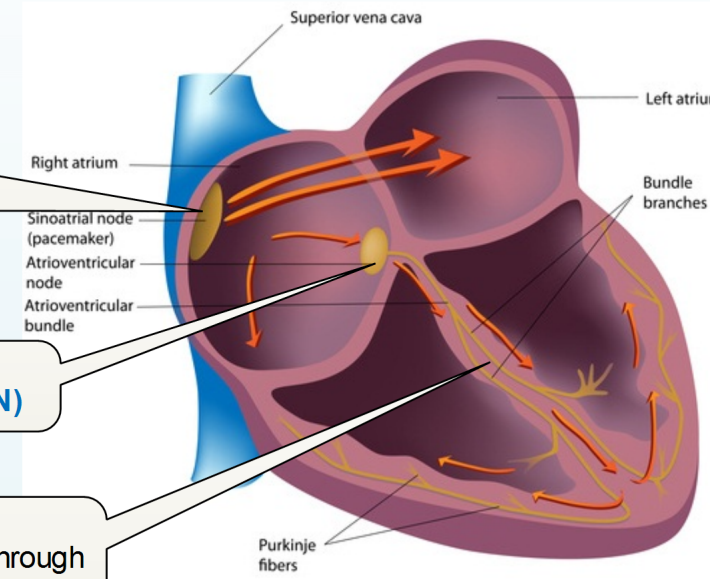
The heart beats rhythmically

Conducting system of the heart

1. Impulse starts from sinoatrial node (SAN) that travels through atria → **contraction**

2. Then it reaches **atrioventricular node (AVN)**

3. Then to **atrioventricular bundle (AVB)** then travels through the ventricles → **contraction**



SAN is called the **pacemaker** of the heart as it is → the **most rapidly beating part of the heart** so, SAN controls the heart rhythm and initiates the contraction of the heart

In general .. the part discharging at the highest rate is the pacemaker of the heart

How does the heart contract ?

Electrical change (depolarization) happens followed by **mechanical change** (contraction)

Nerve supply to the heart

- Although the rhythmic beating of the heart is myogenic, it still under the influence of autonomic nervous system by its 2 branches
- SAN receives impulses from sympathetic and vagus (parasympathetic) nerves

Sympathetic nerve

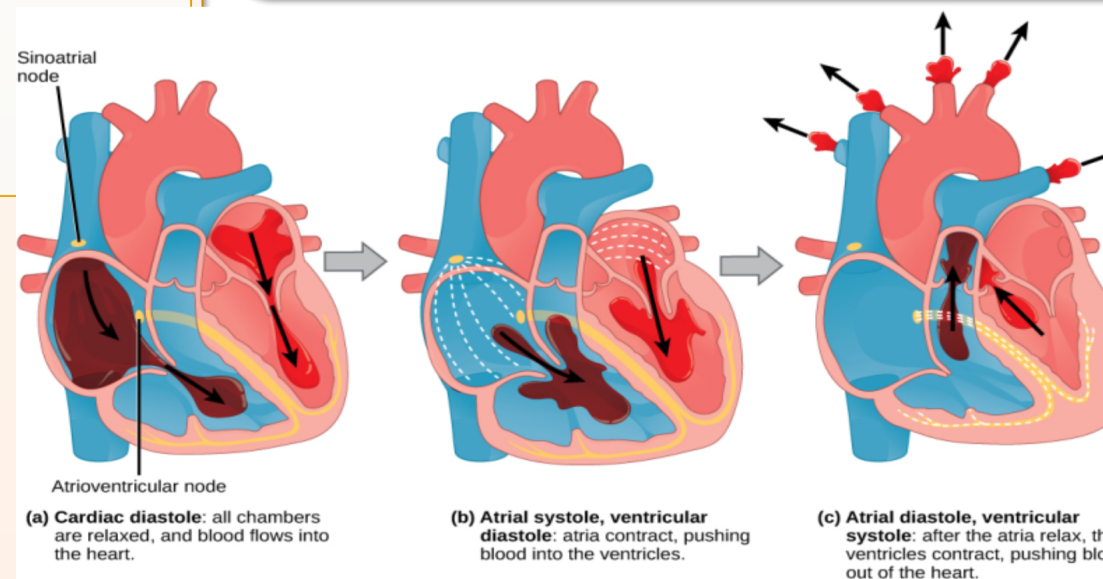
- Release **NA**
- ↑ Heart rate

Vagus parasympathetic nerve

- Release **Ach**
- ↓ Heart rate

Sympathetic and vagus nerves are under the control of **higher centers in the brain**

Neural control of the heart speed the pulse up to **70 beats/min**



Some important definitions

1. Cardiac output (CO)

- Volume of blood (*in liters*) pumped by the heart in one minute
- CO depends on 2 variables:
 - Heart rate
 - Stroke volume

Cardiac output = Heart rate X Stroke volume = 5 L

Cardiac output is connected to **blood pressure**

2. Heart rate

- Number of beats in one minute
- Normally 70 beat/min
- If the drug ↑ **Heart rate** → so it has **positive chronotropic** effect → causes **tachycardia**
- If the drug ↓ **Heart rate** → so it has **negative chronotropic** effect → causes **bradycardia**

3. Stroke volume

Volume of blood (*in ml*) ejected by the heart in **each beat** (in normal adult about 70 ml/beat) It indicates **force of contraction** of the heart
 ↑ SV → ↑ force of contraction → **positive inotropic effect**